

## SLIDE FASTENER TAPE

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a slide fastener tape obtained by weaving. More particularly it relates to a slide fastener tape without fear of so-called puckering which makes the tape protrude in a plane toward an element mounting side or its opposite side so that the tape deforms to be in a shape of an arc, even after coupling elements go through various heat treatments and attached on the tape.

#### 2. Description of the Related Art

A slide fastener tape (hereinafter referred to as a fastener tape) is a tape exclusive of slide fastener which has a plurality of elements for engaging or a with mating elements, fixed along a side edge portion of the tape at regular pitches and is attached with a slider and top /bottom end stops, and which is sewed to clothes or various kinds of bags after it is produced into a required length.

This kind of fastener tape is cut into a desired length after it passes a number of steps for thermal setting, dying, drying, element installation and the like after being woven. A slider is placed so as to pass between opposing elements and the top/bottom end stops are attached. When the tape is heated in the respective steps for thermal setting, dying, drying and

the like, thermal stress, tensile force, compression force and the like in various directions are applied to the fastener tape, thereby causing various deformations such as expansion and contraction of the tape in a warp direction and a weft direction thereof.

The aforementioned fastener tape comprises a tape main portion and an element-mounting edge portion provided on a side edge of the tape. In order to increase an element mounting strength of the tape as well as to stabilize a mounting configuration of each element, a core string thicker than the other warps is fixed along a longitudinal direction of the tape at the same time when the tape is woven.

Due to a difference in structure between the tape main portion and the element-mounting edge portion, generally the element-mounting edge portion in which the core string is disposed has a smaller thermal contraction coefficient than that of the tape main portion. As a result, in the fastener tape which have passed various heat treatment processes, the tape main portion gets contracted largely, so that so-called inverse puckering is likely to occur in which the element-mounting edge portion is protruded outward to be a shape of an arc.

On the other hand, when the elements are being mounted, a large tension is applied to the fastener tape, particularly the element-mounting edge portion of the fastener tape in order

to secure a certain mounting pitch of the elements, so that the elements are mounted in a state where the element-mounting edge portion is stretched. Consequently, even after the tension is released, the portion on which the elements are mounted is not contracted back to its original shape and maintains the expanded state. As a result, the element-mounting edge portion of the fastener tape gets protruded more largely, so that the inverse puckering is more likely to occur. This tendency is remarkable in the case of a slide fastener which is required to have flexibility and stretch.

To solve such a problem, for example, Japanese Patent Application Laid-Open No. 59-51807 proposes a fastener tape composed of dual double-sided knitting structure, in which a textured yarn is employed as a composing yarn for a tape main portion of the tape, a core string covered with covering yarns continuous from the tape main portion is disposed in a element-mounting edge portion of the tape, and in which the thermal contraction coefficient of the core string is kept higher than the thermal contraction of the textured yarn.

With such structure, due to a difference in the thermal contraction coefficients between the element-mounting edge portion and the tape main portion, the element-mounting edge portion takes a so-called normal puckered shape in which the element-mounting edge portion is curved to assume an inward concave, when heat treatment is executed. However, due to the

stretch of the tape main portion, a fastener stringer excellent in linearity could be obtained even after the elements are mounted. As a result, this fastener tape can be attached to clothes rich in flexibility and stretch in a well-fitting state.

Because the above-described fastener tape is constructed with a double knitting structure, the tape main portion has stretch. Thus, even if a normal puckering occurs, the linearity can be obtained by a contraction performance even when the fastener stringer is completed with elements being mounted thereon.

However, if yarns which have no stretch and are used for an ordinary fastener tape material are employed in a fastener tape constructed with an ordinary weaving structure, the tape main portion does not have stretch due to the weaving structure. Therefore, once a puckering occurs in the fastener tape, the fastener stringer cannot correct its puckered state to linear state. Consequently, when the fastener tape is sewed to clothes or the like, the sewing procedure becomes complicated. Further, after the sewing, the slide fastener attached to clothes or the like is not flattened in a longitudinal direction thereof, which results in many inferior products assuming waving states.

#### SUMMARY OF THE INVENTION

The present invention has been achieved to solve the above-described problems and therefore, an object of the present invention is to provide a fastener tape for obtaining a fastener stringer capable of securing linearity without generation of puckering especially in an element-mounting edge portion thereof even after the elements are mounted thereon.

To achieve the above object, according to the present invention, there is provided a slide fastener tape having a tape main portion obtained by weaving and an element-mounting edge portion, in which a core string is woven, wherein a foundation warp used for the tape main portion has a lower thermal contraction coefficient than the other warps, the core string has a high thermal contraction coefficient, and a warp adjacent to the core string at an inner side thereof has a thermal contraction coefficient higher than the foundation warp used for the tape main portion and lower than the core string.

According to the present invention, the fastener tape right after having been woven is in an inverse puckered state in which the element-mounting edge portion is protruded slightly outward so that it is curved. If dry-heating set in a short time is executed to the fastener tape having such a configuration, the contraction of the element-mounting edge portion and the contraction of the warps disposed in the tape main portion are not so different, but only the contraction

of the element-mounting edge portion is slightly larger. As a result, the inverse puckering, which is likely to occur right after a fastener tape is woven, is eliminated, so that the fastener tape can be substantially linear.

The contraction of the fastener tape due to dying next to the above-mentioned process decreases in an order of the core string, the warps adjacent the core string and the tape main portion. Then, at the same time when the normal puckered state in which the element-mounting edge portion is pulled inward in a form of an arc, bias in which the tape main portion is waved occurs. Fastener elements are attached to the fastener tape after this dying step is completed. At the time of this element mounting, a large tension is applied to the element-mounting edge portion. Although the element-mounting edge portion is stretched by the tension at the time of the element mounting, the stretch is smaller than the contraction due to heating, so that the element-mounting edge portion is kept substantially linear. On the other hand, the tape main portion is not stretched when the elements are mounted. As a result, the bias state is maintained.

A slider and upper/lower end stops are attached to a fastener chain in which elements of fastener stringers obtained by mounting fastener elements onto the fastener tapes engage with each other. After that, the slider fastener chain is cut into a required length, so that a slide fastener can be produced.

As mentioned above, the thermal contraction coefficient of the core string at the element-mounting edge portion of the fastener tape is provided to be higher than the thermal contraction of the warps adjacent to the core string at the inner side thereof, so that a difference in thermal contraction between the element-mounting edge portion and the tape main portion is made to be gradual. Thus, no bumping contraction behavior occurs in a boundary area between the element-mounting edge portion and the tape main portion. When this slide fastener is sewed to an object product, the element-mounting edge portion of the fastener stringer is kept straight. Therefore, sewing operation can be executed accurately and after the sewing, a product good in appearance can be obtained because the slide fastener does not get waved in its longitudinal direction.

Further, according to the slide fastener tape of the present invention, it is preferable that the warp adjacent to the core string at the inner side thereof is composed of two paralleled yarns. Because two warps are arranged together, the total thickness of the yarn can be easily increased. Furthermore, when it is subjected to heat treatment, each yarn can move independently more easily, so that the contraction can be achieved securely. As a result, the element-mounting edge portion can be contracted independently of the tape main portion.

Furthermore, according to the slide fastener tape of the present invention, it is preferable that the foundation warp in the tape main portion is set to be thicker than the yarn composing the warp adjacent to the core string at the inner side thereof.

Still further, according to the slide fastener tape of the present invention, it is preferable that a weft is composed of two paralleled yarns, and the total thickness thereof is set to be smaller than the total thickness of the two paralleled yarns of the warp adjacent to the core string at the inner side thereof.

Although the weft is crimped largely at an intersection between the core string and the adjacent warp, the core string and the adjacent warp are hardly crimped but remain substantially linear. As a result, free motion in the warp direction can be secured. Therefore, it is possible that the fastener tape is contracted and set quickly through various kinds of heat treatments, while it is hardly stretched when the elements are injection-molded.

Still further, according to the slide fastener tape of the present invention, it is preferable that each of the foundation warp used for said tape main portion, the warp adjacent to said core string at the inner side thereof and the weft is composed of a textured yarn. When a textured yarn is employed for each of the foundation warp, the warp adjacent



to said core string at the inner side thereof and the weft, the tape becomes thick so that the tape shape can be stabilized and can secure flexibility.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an enlarged partial perspective view schematically showing a typical embodiment of a weaving structure of a fastener tape of the present invention;

FIG. 2 is a sectional view taken along the lines II-II of FIG. 1; and

FIG. 3 is an explanatory diagram schematically showing changes of the shape of the fastener tape in respective processing steps.

#### DESCRIPTION OF EMBODIMENTS

Hereinafter, embodiments of the present invention will be described in detail with reference to the accompanying drawings.

FIG. 1 shows a weaving structure of a fastener tape of a typical embodiment having a basic structure of the present invention. Meanwhile, the weaving structure shown in this FIG. 1 is represented roughly for easy understanding and actually, it is a dense structure as shown in FIG. 2.

Generally, the woven fastener tape 1 of this kind is woven by a narrow-width weaving machine, which is called a

needle-weaving machine. Consequently, a single yarn is reciprocated in an opening so that two paralleled yarns are inserted as a single weft 2. Although in this drawing, the two inserted yarns 2a, 2b composing the weft 2 are separate from each other vertically, they are actually in tight contact with each other in the vertical direction. Then, a loop end, which is formed at a return end of the weft 2, is entangled with a loop end of a weft 2 to be formed next with a latch needle, so that an edge portion 3 is formed on an side edge portion of the fastener tape 1. As shown in FIG. 2, fastener elements are attached on the other side edge portion opposite to the edge portion 3 formed by entangling the loop ends of the wefts 2.

Specifically, the fastener tape 1 is comprised of an element-mounting edge portion 4 located at an edge portion opposite to the edge portion 3 formed by entangling the loop ends of the wefts 2 and on which the fastener elements are mounted, and a tape main portion 5 extending from the element-mounting edge portion 4 to the edge portion 3. For the yarns 2a, 2b composing the weft 2 of this embodiment, a fine textured yarn made of polyester of 330 Tex is used.

For two warps 6a, 6b disposed at the outermost side of the element-mounting edge portion 4 in the illustrated embodiment, nylon-based multifilament, which is thinner than the other warps 6c, 6d, 6e... 6m, 6n, is used. Two core strings

7a, 7b are disposed adjacent to those two warps 6a, 6b at an inner side thereof. Further, two pairs of warps 6c, 6d, each of which is composed of two paralleled yarns, are disposed adjacent to the core strings 7a, 7b at the inner side. Thus, the element-mounting edge portion 4 is formed. Further, the tape main portion 5 extending from the inner side of the warps 6c, 6d to the edge portion 3 includes a plurality of foundation warps 6e, 6f...6m, 6n.

In the present invention, in order to prevent occurrence of the puckering upon manufacturing the fastener stringer, it is important that a high contraction is secured in the core strings 7a, 7b and a degree of the tape stretch at the side of the element-mounting edge portion 4 after the fastener tape 1 passes the dying step is suppressed low so as to protect a core string section from being stretched when the fastener elements are injection-molded (not shown). Thus, the core strings 7a, 7b are respectively covered with knit tubes 7a", 7b", which are obtained by intersecting sinker loops each composed of plural knitting yarns so as to surround core materials 7a', 7b', as in the same manner as the core string structure disclosed in Japanese Patent Application Publication No. 55-21605. According to this embodiment, denatured polyester base multifilament of 670 Tex is used for the core materials 7a', 7b' and its boiled-water thermal contraction coefficient is set to be as high as 15%.

Further, in order to prevent occurrence of puckering when the fastener stringer is manufactured, it is important that the warps 6c, 6d disposed adjacent to the core strings 7a, 7b at the inner side are also not stretched by liquid pressure upon injection molding of the fastener elements and in the dying step, likewise the core strings 7a, 7b. For this reason, non-drawn raw yarns made of polyester-base multifilament composed of two paralleled yarns are employed, so that the total thickness of the two paralleled yarns 6c, 6d is  $2 \times 560 = 1120$  Tex, which is larger than the diameter of the other foundation warp 6e, 6f... 6m, 6n and the boiled-water thermal contraction coefficient is set as high as 10%.

On the other hand, as the aforementioned foundation warps 6e, 6f... 6m, 6n composing the tape main portion 5, a thick textured yarn made of polyester-base multifilament of 660 Tex is used and its boiled-water thermal contraction coefficient is 7%. By using such a thick textured yarn, the fastener tape 1 can be provided with flexibility and at the same time, an appropriate thickness. Further, the reason that the thermal contraction coefficient is set higher than an ordinary fastener stringer having this kind of weaving structure is to minimize occurrence of a wave state (hereinafter referred to as bias) of the tape main portion 5 even after the fastener stringer is manufactured.

Further, according to this embodiment, the weaving

structure of the fastener tape 1 has a feature.

The weaving structure shown in FIG. 1 indicates a typical embodiment of the present invention, but the present invention should not be restricted to this structure and various modifications are possible. The same can be applied to the above-described weft 2, warps 6a, 6b, 6c... 6m, 6n and the core strings 7a, 7b. The size, material, thermal contraction coefficient, structure and the like may be changed in various ways within a scope of technical idea of the present invention.

The weaving structure shown in FIG. 1 will now be described briefly. The two warps 6a, 6b disposed at the outermost side edge portion opposite to the edge portion 3 compose an edge portion 7 which supports folded-back portions of the wefts 2, so that the two yarns 2a, 2b composing the weft 2 are folded back so as to be entangled with each of the two warps 6a, 6b alternately.

The two core strings 7a, 7b disposed on the element-mounting edge portion 4 are disposed and woven in front and rear faces of the tape such that they sandwich the tape faces as shown in FIG. 2. The contact faces of the core strings are supported by two pairs of the wefts 2 (each pair includes two yarns) while the opposite front and rear faces thereof are respectively supported by another pair of the wefts 2 between the aforementioned two pairs of the wefts 2 alternately. As a result, these core strings 7a, 7b are permitted to move freely

in the warp direction. The respective two pairs of the wefts 2, 2 alternately run over the respective two pairs of the warps 6c, 6d at front and rear sides thereof, which are adjacent to the core strings 7a, 7b at the inner side thereof, so as to oppose to each other. As a result, the warps 6c, 6d are suppressed from moving in the warp direction more firmly than the core strings 7a, 7b.

On the other hand, the weaving structure of the tape main portion 5 is an ordinary plain weaving structure in which the weft 2 composed of two paralleled yarns is regarded as a single pair. In this weaving structure, the thermal contraction coefficient is the lowest and the total thickness thereof is  $2 \times 330 = 660$  Tex, which is smaller than the thickness of each of the core strings 7a, 7b or the total thickness of the two paralleled warps 6c, 6d adjacent to the core strings. Thus, crimp of the weft 2 at an intersection of the core strings 7a, 7b or the adjacent warps 6c, 6d and the tape main portion 5 is large while the core strings 7a, 7b and the adjacent warps 6c, 6d are hardly crimped, but substantially linear. Therefore, a motion in the warp direction of the fastener tape such as contraction and stretch at the time of heat treatment, dying or installation of elements is less affected by the weft 2, so that the fastener tape is contracted quickly and set up by various kinds of heat treatments, while the tape is prevented from stretching at the time of injection of the elements.

By employing the above-described weaving structure and warps of different kinds in this embodiment, the configuration of the fastener tape 1 changes as shown in FIGS. 3A to 3E each time when it passes each predetermined heat treatment process. Thus, upon attaching the elements by injection, it is possible to obtain a linear configuration of the fastener stringer 8 with no puckering, especially at the side of the element-mounting edge portion 4, so that sewing of this fastener tape to an object product is facilitated.

Specifically, as shown in FIG. 3, firstly the fastener tape 1 right after having been woven is woven in a puckered condition in which the element-mounting edge portion thereof is protruded outward as shown in FIG. 3A. Although at the time of completion of the weaving, little bias is generated in the element-mounting edge portion 4, the tape main portion 5 is slightly biased.

If this woven tape is thermally set under, for example, 180°C for a minute, the core strings 7a, 7b and the warps 6c, 6d each composed of two paralleled yarns are contracted so that the element-mounting edge portion 4 becomes substantially linear. Because a processing time of this thermal setting is short, the core strings 7a, 7b and the warps 6c, 6d are not yet contracted completely. If the woven tape is assumed to be 100 cm, the contraction of the element-mounting edge portion 4 upon this thermal setting is substantially 4.38 cm and the

contraction of the tape main portion 5 at an end portion thereof is substantially 4.21 cm. Therefore, the bias of the tape main portion 5 is increased.

Next, when the fastener tape 1 is drenched in a high pressure dying solution of 130°C so as to be dyed for 40 minutes, although all the warps 6a, 6b, 6c... 6m, 6n are contracted completely as well as the core strings 7a, 7b, the core strings 7a, 7b and the warps 6c, 6d each composed of two paralleled yarns are contracted more, so that a normal puckered condition, in which the side of the element-mounting edge portion 4 is pulled inward in a shape of an arc inversely to the inverse puckered condition, occurs. At the same time, wave-like bias occurs at the side of the edge portion 3 of the tape main portion 5. According to this embodiment, the element-mounting edge portion 4 was contracted further by 0.94 cm by the dying, while a further contraction of the tape main portion 5 was 0.36 cm. However, no bias occurred in the element-mounting edge portion 4, but the bias of the tape main portion 5 was increased.

Subsequent to the dying, the fastener elements E are injection-molded and integrated with the element-mounting edge portion 4 of the fastener tape 1. Upon this injection molding, a predetermined tension is applied to the element-mounting edge portion 4 so as to be stretched slightly. After the elements E are molded, as shown in FIG. 3D, the tape main portion 5 is not affected by the molding so that bias is left. However,



because the element-mounting edge portion 4 becomes linear, the bias in the tape main portion 5 is reduced relatively. When this fastener tape is sewed to an object product 9, a straight sewing line ML can be obtained as shown in FIG. 3E and a product neat in appearance, in which the slide fastener never waves in the longitudinal direction thereof, can be obtained.

A typical embodiment of the present invention has been described above, but the materials of, for example, the core string composing the element-mounting edge portion, the warp adjacent to the core string at the inner side thereof and the warp composing the tape main portion and the weaving structure of these yarns are not restricted to the above described embodiments. It is easily understood that the present invention may be modified in various ways within a technical scope of the present invention.